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THE RIGHI - MARCONI REPORT THROUGH NEW UNPUBLISHED DOCUMENTS

Premise

A hundred years after the invention of wireless telegraphy in Bologna, the city that has played such an important role in this great achievement, and, in particular, at the Department of Physics of its University, it is still possible to hear told by of some senior technician or lecturer to have heard that Augusto Righi (1850-1920) - then already an established scientist, professor and director of the Institute of Physics - and Guglielmo Marconi (1874-1937) - rich young man full of ideas and hopes - they had been in contact with each other and that Augusto Righi had been like a Master for Guglielmo Marconi, allowing him also the use of his equipped physics laboratory.

By now, these are second-hand oral traditions. What weight do you attribute to it? This is the first question .

It seemed important to me to clarify the actual relationships - if ever there were any - among the remembered characters to control these historical sources, trying to ascertain their origin and reliability.

A Master Pupil Report

Thanks to recent research [\[551\]](#) it has been possible to trace an interesting testimony of about thirty years ago.

This is a letter written by Giulio Cesare Dalla Noce - then professor of the Institute of Physics - on 26 July 1962 to Mr. Alberto Collina, technical expert of the Institute. The letter takes its cue from the request to GC Dalla Noce by the photographer of "Il Resto del Carlino" to be able to photograph some "memories of Marconi" kept at the Institute of Physics. From Noce he informs Collina that he has sent to the Editorial Staff of "Il Resto del Carlino": "the little I had", without however indicating what he had delivered. And so it continues:

"The Institute of Physics and myself, we have little of Marconi who, rightly coming to celebrity, seemed to have forgotten about the Institute of Physics; and instead I know, for testimonies of Ugo Rangoni [technician of A. Righi] and for frequent interviews with the son of Augusto Righi, engineer Aldo, who often Guglielmo Marconi attended the old Institute of Physics at the University, went to the lessons of Meteorology held by Prof. Righi, and then once entertained with Rangoni, absent the Prof. Righi, in the laboratory of these, where he was installed a transmitting device of the Hertzian waves and the receiving apparatus, perhaps at about ten meters. Naturally, the receiver was sparked in the famous receivers of Righi ... " [\[552\]](#)

This is a recent confirmation of other testimonies we have been collecting for some time.

A first statement in this sense is that of prof. Angelo Monti - who argued:

"It was from the experiments of Righi that Marconi ... made his moves for his brilliant discovery, and it was in the workshop of the Maestro that Marconi began the first research for distance transmission.

Let us remember, among the experiences of distance transmission ... the one on the distance of twenty meters carried out in 1889 from one end to the other of a corridor in front of a classroom of the

Faculty of Letters in via Zamboni 33 in the presence of Marconi. " [\[553\]](#)

It is an interesting testimony - even if like the previous one it will have to be checked for its verification or refutation. Among other things, it indicates 1889 as the date of cultural relations between A. Righi and G. Marconi!

Whatever weight one wishes to give to this last testimony and to its relative dating it finds a confirmation (even if without a precise temporal indication) that we could define above any suspicion in a quotation by Bernardo Dessau - former assistant of Augusto Righi and in followed director of the Institute of Physics of Perugia - in a famous conference on Augusto Righi's Scientific Work held in front of the Italian Physical Society meeting in Congress on March 13th 1907, on a date in which both Augusto Righi and Guglielmo Marconi they were still alive and could easily deny it. Dessau, at some point in his speech, expresses himself like this:

"Righi, as a true scholar of science, did not ask his work for any other satisfaction than that which derives from the disinterested search for truth.

But we know that his research on electric waves also had a result of the utmost practical importance, the possibility of which had revealed itself to the brilliant intuition of the young Marconi, when, present myself, he had the opportunity to know in the laboratory of Righi the devices they designed and the purposes for which they were to serve. " [\[554\]](#)

It is an interesting quote also because, like the previous one, it comes from a direct witness to those events.

For the sake of truth, we must add that this declaration of 1907 was later, 1938, mitigated by Dessau with a testimony in front of a notary:

"In the years 1894 and 1895 Professor Augusto Righi was concerned with creating effects and phenomena analogous to the main optical phenomena with electric waves and thus placing on that secure experimental basis the intrinsic identity between the two groups of phenomena that Henry Hertz did not have. still able to demonstrate completely The short waves necessary for this purpose, Righi obtained them with an apparatus of his creation, called oscillator, which was placed along the focal line of a metal mirror in the form of a parabolic cylinder, and a similar mirror then collected the waves above a linear reservoir [sic, in the original; obviously, a linear receiver] placed on its focal line.

The young Marconi's visits to Prof. Righi belong to that time. I myself knew Marconi finding myself in one of the rooms adjacent to the physics classroom; environments in which I usually worked and where he waited to be received by the Professor. But the visits of Marconi to Righi took place in the latter's laboratory, a room, which was accessed not only from the side of the classroom, but even more directly by climbing the staircase of the entrance of Via Zamboni 31. To the visits of the Marconi in that room, I have never been present, being busy more than anything in the preparation of the experiences for the lessons, in the exercise of the students, and in the researches of the undergraduates. But the young Aldo, son of Righi, who in those years I often saw coming to spend hours in his father's workshop, he will certainly remember having seen Marconi there. From the mouth of prof. Righi I knew that Marconi came to talk to him about inventions and his own projects, and since in the room where Righi received him, all the equipment for the study of oscillations and electric waves was in full view, the attention of the young Marconi cannot but be she was struck by those devices and he must have asked Righi for clarifications.

By Righi's mouth I also learned of Marconi's visits to the Villa di Sabbiano di Montagna where he spent the summer with his family in those years and overlooking the Villa del Grifo, down in the Reno Valley where Marconi lived. Righi also told me that these visits were dedicated to the conversations the young man wanted to have with him about his projects. " [\[555\]](#)

The contradiction between the declaration of 1907 and that of 1938 is obvious. In both it is clearly stated that there were meetings between the two characters, but in the first Dessau provides an explicit

confirmation declaring, without hesitation, "me present", in the second it is said equally clearly "I have never been present".

In the history of science, as historians, we are accustomed to these conflicting, or even contradictory, statements by famous people who return with memory to episodes that occurred - as in this case where the facts date back to 1895 - forty years earlier.

Einstein himself was taken as an example of conflicting statements. [\[556\]](#)

The reasons? Multiple. First of all, probably, limits of human memory, to which people of great intellectual qualities are also subjected.

In any case, present or absent Dessau, the meetings between Righi and Marconi seem to have surely taken place.

The following testimonies are the proof that we will now propose.

In fact, a further confirmation of the experiences conducted by Righi in the period 1894/1895 is provided by a testimony of Count Giuseppe Manzoni-Ansidei, to whom a complete legal value can be attributed, because it took place in the presence of the notary Antonio Magli of the District College Notary of Bologna, on 3 July 1939. In the testimony you can read the following words:

"... Ready to swear by swearing before the competent authorities attested:

In the year 1895 (school year 1894-1895) being enrolled in the two years of mathematics in the R. University of Bologna, I attended the free course in meteorological physics held by Augusto Righi.

I remember very well from the other lessons all full of great interest, for the topical subjects that the illustrious teacher treated those on the Hertzian waves, and among these especially one of which I have very much alive the memory for the singularity and importance, and, I will say of absolute novelty.

We were in 1895.

Righi to highlight the Hertzian waves had placed a Hertz resonator in the chair of the ancient physics classroom combined with a parabolic mirror. The resonator was also joined to a gold leaf electrophorus placed under a pneumatic bell where the vacuum had been made.

In another room of the physics cabinet, away from the classroom, Righi had placed an electric producer and between this and the chair in the various intermediate rooms, he had suspended, isolating them, pieces of copper wire separated and remote from each other.

At one time the electric producer worked and I and the other students could clearly see the gold leaflets of the electrophorus moving away from each other, thus signaling that the electric waves had been collected.

Experience was followed by a great exposition on the part of the great Master who illustrated to us the importance of electric waves, and in making his speech he mentioned that he was thinking of replacing the pieces of copper wire mentioned, a device such as an antenna, which could collect electric waves, an antenna which he then conceived, as also mentioned the possible capture of waves, which, produced in special ways and sizes, could be used for special signals.

Certainly Guglielmo Marconi, who told me he was attending those lessons, as was notorious that he attended the University's physics cabinet and had frequent meetings with Righi, will have treasured those great Master's researches that in those lessons seemed to divination the telegraph without wires and even the radio. " [\[557\]](#)

Other testimonies that confirm the relationships between Righi and Marconi come from Augusto Righi and his son Aldo.

On 21 September 1902 Augusto Righi in Archiginnasio - the ancient university building of Bologna - declared:

"I always remember the visits with the greatest pleasure in telling me of the experiences he ingeniously combined with rudimentary means, and to put aside of planned new attempts from which the passion with which he devoted himself to questions of applied science always emerged .

You predict from then on that Marconi, sooner or later, would have gone on to celebrity. " [\[558\]](#)

Even the testimonies of the engineer. Aldo are particularly interesting:

"Marconi's first meeting with my Father took place in our house. We lived at the time in via delle Belle Arti at the ndeg. 42; the Marconi, presented by mutual friends, wanted to have advice and suggestions from my Father on various inventive ideas and relatives asked if he was to be encouraged by the young man, in his early twenties, or rather to have him choose another path.

Since then, in fact, he became a regular at the meteorological physics course that my Father held ... and began to spend many afternoons in the School of Physics ... to consult scientific books and to confer, from time to time, with my Father the whose experiences on electric waves were then in full development.

I speak of afternoons, because after school I went to do my homework in my Father's study: I had the opportunity to be present at meetings between the two scholars ...

I remember that once upon a time Guglielmo Marconi witnessed the experiences with the three-spark oscillator, equipped with the parabolic reflector to concentrate the beam of electric waves on the receiver, which is also equipped with a reflector ...

During the previous summer Guglielmo Marconi had come several times to confer with my Father.

Our family spent the warm months at the Ca 'Bianca in Sabbiano di Monte, a few kilometers from the city; the Marconi family was at Villa Grifone, just across the Rhine a couple of kilometers as the crow flies, but almost two hours of walking through the gullies.

I perfectly remember the young skinny blond man who was always serious, I would even say severe, who came riding a donkey in the early hours of the morning and to whom it was my job to bring lemon juice. " [\[559\]](#)

These are testimonies that come from the family environment of Augusto Righi which we have taken into consideration; but there are others, concordant, of part, so to speak, Marconian.

The first one we want to remember is provided by Admiral Giuseppe Pession - and refers to Marconi's mother:

"Marconi's mother could see that even Righi, a professor at the University of Bologna, whom his son had met in the city and often went to consult in the countryside, near Pontecchio, where he too was on holiday, even that great a scientist of European renown, he was struck by the scientific culture of his William. " [\[560\]](#)

But also the eldest daughter of Marconi's first marriage, Degna, in the biography dedicated to her father mentions the reports that Guglielmo Marconi had had with Augusto Righi:

"... For his part Guglielmo, who as a boy, having had no regular and complete preparation ... had to give up showing up for the entrance exams at the Naval Academy, he could not even now register ... at the University of Bologna, so he simply had to follow Professor Righi's courses as an auditor.

Professor Righi ... had not been very broad of encouragement for Marconi. He had however allowed him to work in the laboratory ... " [\[561\]](#)

Recently, a letter from Marconi himself to his brother from Livorno and dated 1892 also emerged, giving us a testimony of the relationship of esteem and trust that he had established with Augusto Righi:

["... I am always very busy studying ... to obtain the license of the Technical Institute, or of the Liceo, as was desired by Prof. Righi ..."](#) [562]

A Specific Influence?

The sure conclusion that we can draw for now is that therefore it is certain that Augusto Righi offered human encouragement and lent a cultural, technical-scientific collaboration to Guglielmo Marconi, at the latter's request, in the years between 1892 and 1895. Cauturgically we have rejected the earliest date of 1889.

Having ascertained this point, it is now interesting to ask a second question. Has there been a specific influence, in the field of electromagnetic waves, by Augusto Righi on Guglielmo Marconi? From the previous quotes it would seem so. However, giving an answer, albeit partial, to this question, seemed to us of great importance for a more complete understanding of the birth of wireless telegraphy.

To try again to find an answer, the most objective, and the most specific, possible, it seems to us that the best way is to re-read the writings of Augusto Righi on the electromagnetic waves published in the years comprised approximately between 1892 and 1895 .

The historiographical hypothesis underlying our choice, and which we consider plausible, is that there is a rather high probability that Guglielmo Marconi read those writings.

Citing excerpts can help us understand - at least in part and presumably - how Righi was able to influence, unconsciously, his young and attentive, though unofficial, disciple.

Augusto Righi in his writings on electric oscillations, which were intended to find a further, more effective and didactically evident confirmation of Hertz's experiences in favor of Maxwell's electromagnetic theory is, as usual, particularly clear and explicit.

We will consider some of your articles. The first that seems significant to us was presented on April 30, 1893 at the Accademia dei Lincei in Rome.

Augusto Righi provides a whole series of quantitative data:

"The shortest waves I have are 7 and a half centimeters long ... With these short wavelength devices, the distance to which the resonator and the oscillator can be located, without cease in the first, the sparks, it is relatively considerable ... By fitting the oscillator with a parabolic reflector, the resonator can be brought considerably further, and if it is also in the focus of a parabolic mirror, the sparks are seen up to 6 meters ...

With slightly larger luminaires, which provide wavelength oscillations of 20 cm ... by fitting the reflector oscillator the sparks are seen even at a distance of 7 meters, and even if the resonator has a parabolic mirror, it shows sparks clearly visible even standing 25 meters from the oscillator. " [563]

Righi therefore detects signals even if it is 25 meters from the oscillator. Probably it is the length of the longest corridor of the old Institute of Physics in the University Palace, in via Zamboni in Bologna.

The following year Augusto Righi will be even more explicit in providing information on how to obtain both short electromagnetic waves, which are long in a writing - very broad, and summarizing the whole series of experiments he had carried out in those years - entitled: On Oscillations electric wavelengths, and their use in the production of phenomena analogous to the main phenomena of optics [564]

The discussion consists of more than 100 large format pages that include a Part I, with the *Description of the Appliances* , a Part II with the Experiences in 7 chapters and a Conclusion .

We have described the structure of this work by Augusto Righi and we will cite some passages because we believe that it could exert a strong direct influence on Guglielmo Marconi by offering stimuli of great interest to a mind as ready and attentive as his.

Here is a summary of some pages that seemed more significant to us.

"... Oscillators. A Hertz exciter or oscillator is nothing but a capacitor that repeatedly discharges, through a circuit such that the discharge is oscillating. The oscillation period grows, according to a known formula, together with the capacitor capacity and to the self-induction of the circuit. In Hertz's oscillators the armatures are constituted by the two rods placed on the prolongation of each other, and by the metal plates which in many cases are joined at their farthest ends. " [\[565\]](#)

It is the principle of the oscillator and the suggestion, inherent in the idea of the condenser, of the role of an antenna.

"To obtain very short oscillation periods it was therefore necessary to decrease capacity and self-induction." [\[566\]](#)

Marconi will have to do exactly the opposite to get longer wavelengths.

We continue quoting Righi: "The effects that an oscillator of this kind gives, consisting of balls of a few centimeters in diameter, are very weak, but they grow enormously by resorting to an artifice due to De la Rive and Sarazin, which consists in triggering the spark that connects the two conductors in an insulating liquid. I adopted this arrangement, that is, I placed an insulating liquid between the two spheres, but I found vaseline oil to be very preferable to olive oil, used by the two Genevan physicists, especially making it less smooth by dissolving a sufficient quantity of vaseline. " [\[567\]](#) It indicates how long waves can be obtained and how, in any case, vaseline oil accentuates the signal.

"Finally - continues Righi - I have recently recognized that if the two spheres are hollow, the effectiveness of the oscillator is less than when they are full, which is perhaps not easily predictable. For example with an oscillator formed with massive spheres of almost 4 cm in diameter, the effect on a resonator ceased only at a distance of about 11 meters, while on the same resonator the effect disappeared already at 6 m when those spheres were replaced by two others of equal external diameter but hollow, with wall thickness of about 0.15 cm. " [\[568\]](#) It proposes the use of massive spheres to have signals at greater distances.

Righi continues as follows: "Naturally, suppressing the parabolic reflector attached to the resonator, the said maximum distance decreases, and even more if the oscillator mirror is also suppressed." [\[569\]](#) It detects how the parabolic metallic mirrors already used by Hertz both for the oscillator and for the receiver, accentuate the signal and the possibility of receiving it . Even Marconi will initially adopt this trick.

The above quotations are so clear that no further comments are required.

However, it will be necessary to provide some clarifications. The first. The objectives, the research project of Augusto Righi is totally different from that of Marconi.

Righi takes up Hertz's experiments to confirm the great mathematical construction of the electromagnetic theory of James Clerk Maxwell (1831-1879). His goal is, in particular, to prove Maxwell's electromagnetic light theory beyond doubt. For Righi, after Hertz, little has been done to confirm this great theory which, among others, was opposed by Lord Kelvin and Pierre Duhem. This can be taken into account based on the following quote:

"... But it is easy to explain how it happened that little progress has been made in this way so far. The minimum wavelength obtained by Hertz and its continuators was about 66 centimeters. Such a wavelength would oblige us to do use of very large apparatus, in order to avoid such diffraction phenomena that mask many of the phenomena analogous to those that usually produce light waves.

In order to progress in the demonstration of the aforementioned analogy, it was necessary first of all to create apparatuses with which it was possible to produce and study electric force beams with wavelengths much less than 66 cents, and with this intention I turned from my first investigations. These fortunately led me to realize my project, placing me in a position to experiment with wavelengths of a few centimeters (even of only about two and a half centimeters).

In possession of these devices, which have other peculiar advantages, I have set up experiences several times, from which the most perfect analogy between electric waves and lights has been demonstrated ... " [\[570\]](#)

Ecco, ora la seconda precisazione. Il contesto in cui si muove e opera Righi è quindi molto chiaro. Al di là delle motivazioni e delle idee di Righi, quegli strumenti e quegli esperimenti influenzarono la creatività di Marconi spingendolo a proseguire nelle prove che aveva già iniziato. Righi tentava di sviluppare onde elettromagnetiche sempre più corte, per verificare in laboratorio, a conferma di una teoria generale, ma anche a fini didattici, le leggi dell'ottica per le radiazioni elettromagnetiche. In questo modo realizzò l'ottica delle microonde e confermò la teoria di Maxwell.

Marconi imboccò la strada opposta, quella cioè dello sviluppo di radiazioni di maggior lunghezza d'onda per la trasmissione di segnali a grande distanza, anche al di là di ostacoli naturali. Questa strada gli consentì di creare e sviluppare la telegrafia senza fili.

Gli obiettivi, il progetto di ricerca, il quadro scientifico di riferimento erano quindi notevolmente diversi.

Il riconoscere con chiarezza i ruoli diversi di questi personaggi e dei loro programmi di ricerca non esclude, tuttavia, che Marconi abbia saputo cogliere nell'attività sperimentale di Righi preziosi suggerimenti.

Il Ruolo di Marconi

Per comprendere meglio l'originale e innegabile contributo di Guglielmo Marconi è necessario riflettere su alcuni importanti aspetti.

In primo luogo, la visione chiara e innovatrice da parte di Marconi dell'uso dei segnali elettrici per un sistema di comunicazione a distanza. In secondo luogo si può aggiungere un'interpretazione del ruolo del ricercatore libera di quanto normalmente praticato anche da grandi scienziati dell'epoca. Mi riferisco in particolare, per far comprendere rapidamente e facilmente questo punto alle seguenti parole di Marconi, che si riferiscono alle limitate conoscenze teoriche e matematiche di ogni epoca:

"La mia lunga esperienza mi ha insegnato a non credere a limitazioni fondate su considerazioni puramente teoriche e matematiche le quali, come è noto, sono spesso basate su cognizioni imperfette di tutti i fattori che entrano in gioco.

Ho sempre ritenuto opportuno seguire nuovi indirizzi di ricerca, anche quando questi sembravano, a prima vista, poco promettenti di buoni risultati." [\[571\]](#)

Una tipica conferma a questa citazione è l'aver avuto fiducia da parte di Marconi nelle sue osservazioni sperimentali che passo dopo passo, a distanze sempre maggiori, gli confermavano la realtà fisica della trasmissione dei segnali, nonostante i pareri contrari di grandi matematici e fisici: uno per tutti Henri Poincaré. L'esistenza della ionosfera - costante ignorata da Marconi, come da tutti gli scienziati del suo tempo - fu però in un certo senso e, inconsapevolmente, anticipata da Marconi sulla base delle misure sperimentali in spazi aperti. Là, sul campo, Marconi comprese "praticamente" quello che venne scoperto e interpretato fisicamente solo molto più tardi. E cioè che la ionosfera si comporta come un mezzo rifrangente con indice di rifrazione diverso da 1. L'onda elettromagnetica che si propaga verso l'alto si muove quindi in un mezzo a indice di rifrazione variabile da punto a punto secondo la teoria odierna, quindi, il raggio deve incurvarsi verso il basso se, procedendo dal basso all'alto, l'indice di rifrazione diminuisce. Si raggiungerà una frequenza critica (f_0) caratteristica, per la quale, dato il basso valore della frequenza, è energicamente rifratta dall'atmosfera ionizzata

(ionosfera) così da essere rimandata verso il basso. Consentendo, in questa maniera, la trasmissione a grandi distanze.

In Marconi quindi era presente anche una notevole intraprendenza che lo rendeva libero dagli angusti spazi dei laboratori - anche quelli più attrezzati - del tempo. Il suo campo di sperimentazione era ... l'aria, l'oceano, il libero spazio senza confini. In questo senso, l'opera fisica e ingegneristica di Guglielmo Marconi si è espressa al massimo livello. A lui, infatti, si deve l'individuazione, almeno dal punto di vista pratico, della componente radiativa (e non solo induttiva) delle equazioni del campo elettromagnetico, che sono alla base della trasmissione dei segnali a distanza. La componente induttiva, infatti, scompare rapidamente con l'inverso del quadrato della distanza, mentre l'altro, la radiativa, dà luogo al fenomeno della radiazione elettromagnetica dei segnali.

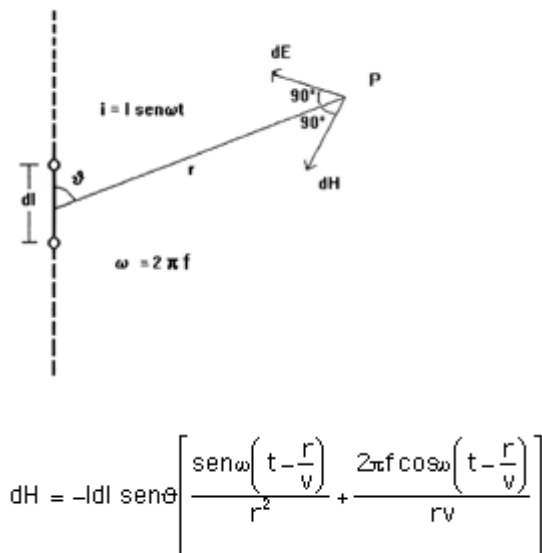


Fig. 1

Se ad un elemento di conduttore dl percorso da una corrente alternata $i = I \sin 2 [\pi]ft$ (dipolo di Hertz) si applicano le equazioni di Maxwell si ottiene per il campo magnetico dH in un punto P l'espressione sopra riportata ove v è la velocità della luce nel vuoto.

Il campo elettrico dE è dato da un'espressione analoga e i due campi, giacenti in un piano normale alla retta r , sono sempre ad angolo retto fra loro.

Nella formula sopra riportata si osserva che il campo magnetico prodotto dalla corrente i si compone di due termini. Il primo, dipendente dall'inverso del quadrato della distanza, è detto campo d'induzione; il secondo, che decresce in ragione della distanza r , è detto campo di radiazione.

Le proprietà fondamentali del campo di radiazione ebbero la loro dimostrazione d'esistenza e la loro utilizzazione pratica su larga scala per opera di G. Marconi quando egli, portando le proprie esperienze fuori dagli angusti confini dei laboratori, riuscì ad ottenere radiocomunicazioni a distanza di decine di Km.

In questo senso, ci sentiamo di condividere, completamente, le seguenti parole degli estensori della voce Radiocomunicazioni dell'Enciclopedia Italiana Treccani:

"Le proprietà essenziali e fondamentali del campo di radiazione ebbero la loro dimostrazione e utilizzazione per opera di G. Marconi quando egli, portando le esperienze fuori dagli angusti confini del laboratorio, riuscì ad ottenere radiocomunicazioni a distanza di qualche diecina di chilometri. Le esperienze di Marconi affrontarono e risolsero in un quarantennio di lavoro l'altro problema capitale delle radiocomunicazioni: la conoscenza del mezzo in cui le onde elettromagnetiche si propagano e le leggi della loro propagazione." [572]

La Stima Reciproca

Ma al di là delle testimonianze, e delle citazioni che abbiamo riportato nel nostro lavoro, e delle considerazioni con cui le abbiamo commentate, quali furono i rapporti pubblici e privati tra Augusto Righi e Guglielmo Marconi negli anni che seguirono al primo brevetto marconiano del 2 Giugno del 1896?

Questo, il terzo interrogativo a cui tenteremo di dare una risposta, grazie alla possibilità che abbiamo avuto di prendere visione diretta del ricco Epistolario scientifico di Augusto Righi[573].

Abbiamo già riferito in altra sede a proposito di un certo stato d'animo che caratterizzò Righi nei confronti di Marconi, e che si può sintetizzare nelle sue perplessità, se non nella sua avversione ad assegnare la Medaglia Matteucci a Marconi[574], stati d'animo che si ripeterono dopo il conferimento del Premio Nobel per la Fisica nel 1909 a Marconi e in altre occasioni.

A ulteriore e più chiara conferma di ciò, possono essere riportate le seguenti parole contenute in una lettera appartenente al Fondo Righi dell'Accademia delle Scienze detta dei XL di Roma. Essa fu scritta ad Augusto Righi il 15 Marzo del 1900 da Charles Guillaume, Segretario (insieme a Lucien Poincaré) del Comitato Organizzatore del Congrès International de Physique che si sarebbe tenuto nell'Agosto di quell'anno a Parigi. Si può leggere:

"... Une partie de votre lettre m'a vivement attristé. Mes collègues et moi, nous pensions, en effet, que M. Marconi avait tiré grande partie de vos admirables expériences pour faire fortune. Mais nous ne pensions pas qu'il eut été aussi indélicat. Votre lettre ne laisse plus subsister aucun doute dans notre esprit; il vous a volé le fruit de votre travail..."

Nonostante questi momenti, Augusto Righi seppe sempre vedere le cose, anche personali, con il dovuto distacco, segno evidente di una grande signorilità ed umanità.

In ogni caso i rapporti personali tra questi due grandi protagonisti della Bologna a cavallo dei due secoli furono sempre improntati alla massima stima reciproca.

Il 6 Luglio 1897 Guglielmo Marconi in occasione di un ricevimento ufficiale offertogli dall'Associazione Elettrotecnica Italiana inviava a Righi un telegramma con parole piene di apprezzamento:

"Sezione romana e presidenza dell'Associazione elettrotecnica italiana riunita banchetto onore Marconi, proponente Marconi stesso, inviano unanime plauso illustre prof. Righi, i cui studi sono fondamento nuova invenzione. Ascoli"[575]

Augusto Righi rispondeva in questi termini al Presidente dell'AEI, Professor Ascoli:

"Vivamente ringrazio Lei, Associazione Elettrotecnica e Signor Marconi, pel gentile telegramma inviatomi, ora ricevuto, lietissimo se il mio oscillatore troverà anche nel campo pratico quel successo, che ragionevolmente puonsi sperarne."[576]

Non solo, l'8 Luglio 1897, in una nota a "Il Resto del Carlino", Righi aveva scritto così:

"Ma non scema affatto il merito che giustamente spetta al Marconi, e cioè quello di aver avuto l'idea di applicare questi apparecchi alla telegrafia senza fili. Per quanto quell'idea fosse, come si suol dire, nell'aria, nessuno prima di lui aveva tentato di tradurla in atto ..." [577]

Anche in un incontro diretto tra questi due personaggi il 21 di Settembre del 1902 - meno di un anno dopo la grande trasmissione transatlantica - presso l'Archiginnasio a Bologna le dichiarazioni sono improntate a grande stima reciproca.

Marconi: "Ho piacere in special modo di vedere qui presente il Prof. Righi. Egli ha fatto grandi studi sulle onde elettriche ed il risultato dei suoi studi profondi ha molto giovato alle mie scoperte." [578]

Righi: "... Sono lieto che mi si presenti così l'occasione di porgergli pubblicamente il mio sincero plauso. Nessuno forse meglio di me poté apprezzare mentre si svolgevano e si esplicavano,

l'eccezionale intuito inventivo e le sue rare doti intellettuali." [579]

L'anno successivo, 1903, Righi in una lettera datata 12 Marzo, così si esprimeva a proposito di un suo ventilato ruolo di Maestro nei confronti di Marconi.

"... So poi che di recente venni ripetutamente qualificato come Maestro di Marconi.

D'un tal titolo sarei molto lieto; ma bisognerebbe che a quel vocabolo si potesse dare un senso molto lato, per applicarlo a chi col giovane inventore ebbe solo dei colloqui, il più delle volte su progetti di esperienze e di applicazioni pratiche diverse da quelle che lo hanno meritatamente reso celebre, e tutt'al più ebbe campo di fornirgli spiegazioni, schiarimenti e consigli intorno a quei progetti ..." [580]

Come sempre sono parole improntate alla modestia, alla sincerità, all'onestà intellettuale.

Ma il quadro di riferimento più completo del ruolo ricoperto da Marconi nel campo della telegrafia senza fili, Righi lo fornisce nel volume La Telegrafia senza filo, scritto da lui stesso in collaborazione con Bernardo Dessau, nel 1903.

E' Dessau che ha il compito di occuparsi delle questioni di priorità e che ricostruisce chiaramente quanto Marconi poteva aver appreso da altri studiosi che si interessarono delle onde elettromagnetiche, e quale fu il merito specifico di Marconi.

"... Infatti, se all'apparecchio produttore delle onde descritto da Marconi nel suo primo brevetto ... confrontiamo quello a tre scintille del Righi ... riscontriamo fra di essi una identità perfetta...

D'altra parte, l'apparecchio ricevitore sensibile alle onde non è altro che il tubo a limatura di Calzecchi Onesti od il coherer di Lodge. Ed anche l'impiego del soccorritore per chiudere un circuito locale, e del martellino da campanello per ristabilire automaticamente la resistenza della limatura, come pure l'aggiunta dell'antenna all'apparecchio ricevitore, trovasi già nell'apparecchio di Popoff ..." [581]

Nello stesso volume, poi così si prosegue:

"... But he still has the indisputable merit of having taken a daring initiative, where others had been made only of the timid proposals, and of having transported in the practical field what others had only glimpsed or realized on a smaller scale. his ingenuity and inventive faculties were fully revealed later, due to the skill with which he overcame the numerous difficulties, and for so many modifications and additions of detail, largely essential for practical success, which he assembled in that together, which can rightly be called the Marconi system . " [582]

Final considerations

Even wanting to minimize the extent of Augusto Righi's influence on Guglielmo Marconi - and we have shown, we believe, how this is not historically correct - we must recognize that in their meeting the role, function and cultural transmission was exalted , didactics, between an individual and another can have.

It is that impalpable, elusive, unfathomable moment that allows science, humanity, to progress.

Acknowledgments

We thank all the members of the Righi Family and, in particular the nephews Engineers Augusto and Giampaolo Righi for having made available to us many materials belonging to the great scientist who died.

[551] We refer to the historiographical research on the relationship between the technicians and professors of the Institute of Physics of the University of Bologna (1870-1945), funded by the Institute for Cultural Heritage of the Emilia-Romagna Region, performed by GB Porcheddu with the coordination of G. Dragoni.

[552] The letter, traced back to the research indicated in note (1), was recently made available by the heirs of Mr. A. Collina, who thank them here.

[553] P. POLI, *Marconi's Invention and the premonition of Righi*, the historical and cultural institute of the weapon of genius, Rome, 1976, pp. 1-12; cit. p. 10.

[554] B. DESSAU, *The scientific work of Augusto Righi*, anastatic reprint by G. TABARRONI, in "Giornale di Fisica", XI (1970), pp. 61-73; cit. p. 70.

The article is preceded by a presentation by G. TABARRONI, The Conference of Dessau on Augusto Righi, in "Giornale di Fisica", XI (1970), pp. 53-60.

[555] Testimony deposition carried out on 16 September 1938 by B. Dessau to the notary Alberto Tei of Perugia. The text of this declaration - together with another precious and unpublished material - was recently made available by Ing. Giampaolo Righi, whom we wish to thank here.

[556] See G. HOLTON, *Scientific Imagination*, Einaudi, Turin, 1983; cit. pp 236-246; and also H. KRAGH, *Introduction to the historiography of science*, tr.it. Zanichelli, Bologna, 1990; cit. pp. 167-170.

[557] This precious testimony has recently been made available to us by the Righi Family; See note (5).

[558] P. POLI, *The technical-scientific work of Guglielmo Marconi*, C & C, Radioelettroniche Editions, Faenza, 1985; cit. p. 6.

[559] P. POLI, *Marconi's Invention and the premonition of Righi*, op. cit., pp. 11-12.

[560] Ibidem, p. 8.

[561] D. PARESC MARCONI, *Marconi, my father*, Edizioni Frassinelli, Milan, 1993; cit. pp. 23-24.

[562] B. VALOTTI, *The roots of invention: new documents on the young Marconi*, in "Alta Frequenza, Rivista di Elettronica", VII (1995), pp. 31-35; cit. p. 32.

[563] A. RIGHI, *On some experimental arrangements for the demonstration and study of Hertz electric undulations*, in "Reports of the R. Accademia dei Lincei", 30 April 1893, pp. 333-337; cit. pp. 336-337.

[564] A. RIGHI, *On small wavelength electric oscillations, and on their use in the production of phenomena analogous to the main phenomena of optics*, in "Memoirs of the R. Academy of Sciences of the Bologna Institute", May 27, 1894, pp. 485-592.

[565] Ibid., P. 488.

[566] Ibidem, p. 489.

[567] Ibid., P. 489.

[568] Ibidem, p. 494.

[569] Ibid., P. 501.

[570] Ibid., P. 487-488.

[571] G. MARCONI, *Radiocommunications with very short waves*, in "High Frequency", II (1933), pp. 5-24; cit. p. 7.

[572] G. MARCONI, OM CORBINO, *Voice Radiocommunications*, Italian Treccani Encyclical.

[573] *The scientific* correspondence of Augusto Righi, the letters he received, were donated by the Righi Family to the Academy of Sciences known as the XL, Rome-Eur.

A microfilmed copy of this Righi Fund was assigned by the XL Academy to the Physics Museum of our University of Bologna. The microfilm donation took place in September 1988, on the occasion of the Demonstrations for the IX Centenary of the University of Bologna, thanks to the availability of the President of the Academy Prof. GB Marini Bettolo and for the help received from Prof. FA Roversi Monaco , Magnificent Rector of our University.

[574] G. DRAGONI, *Righi's Work between Calzecchi-Onesti and Marconi, in The Conquest of Wireless Telegraphy*, edited by E. FEDELI and M. GUIDONE, Nuova Alfa Editoriale, Bologna, 1987, pp. 103-130.

[575] From "Il Resto del Carlino", 8 July 1897. I thank Prof. G. Tabarroni for introducing me to these testimonies.

[576] Ibid.

[577] Ibid.

[578] P. POLI, *Marconi's Invention and the premonition of Righi*, op. cit., p. 4.

[579] Ibid.

[580] Ibid. Quotation taken from L. SOLARI, *History of Radio.* , Fratelli Treves Ed., Milan, 1939; cit. p. 9

[581] A. RIGHI, B. DESSAU, *The wireless telegraphy* , Zanichelli, Bologna, 1903; cit. p. 287.

[582] Ibidem, pp. 287-288.



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